# Gravimetric Analysis of Epsom Salt

## Purpose

To determine the empirical formula of Epsom salt by gravimetric analysis

## Introduction

Epsom salt is a hydrate composed of magnesium and sulfate ions complexed with water molecules. In this lab, you will utilize simple stoichiometry to determine the percent composition of each species in Epsom salts as well as the empirical formula of Epsom salt.

## Procedure

### I. Determination of Percent Magnesium in Epsom Salt

Take about one half gram of Epsom salt and dissolve it into about 15 mL of distilled water in a 100 mL beaker. To this solution, add 5.0 mL of 1.0 M KOH and stir with a stirring rod. Record observations. Record the mass of a circular filter paper, and collect the precipitate via gravity filtration. Rinse the beaker with enough 1.0 M NaOH to remove any solids left behind in the beaker. Following this, wash the precipitate twice with 10 mL of distilled water. After filtration, allow the solid to dry overnight in the fume hood and then heat for one hour in drying oven set to 70$^{o}$C the next day. Then, take a final mass of the dry precipitate and filter paper. Dispose of solid as instructed by your teacher.

### II. Determination of Percent Sulfate in Epsom Salt

Take about one half gram of Epsom salt and dissolve it into about 25 mL of distilled water in a 100 mL beaker. After the solid has completely dissolved, add 40 mL of 0.10 M $Sr(NO_3)_2$ and stir with a stirring rod. Record observations. After the precipitate has formed, heat the mixture with a hot plate to a temperature just below boiling and continue heating for 15 minutes. After this, allow the solution to cool to the touch and collect the precipitate via gravity filtration. Rinse the beaker with the supernatant using a rubber policeman to remove any precipitate clinging to the beaker walls. Following this, wash the precipitate twice with 10 mL of distilled water and allow the solid to dry overnight in the fume hood. Then heat for one hour in drying oven set to 70$^{o}$C the next day. Then, take a final mass of the dry precipitate and filter paper. Dispose of solid as instructed by your teacher.

### III. Determination of Percent Water in Epsom Salt

Take about one gram of Epsom salt and grind the sample using a mortar and pestle to a fine powder. Following this, place the sample in a pre-massed, pre-dried evaporating dish and record the mass of the ground Epsom salt and evaporating dish together. Then heat the evaporating dish and Epsom salt with a Bunsen burner for 15 minutes. Let the dish cool in a dessicator and record the mass. Be sure all of the water has been removed by heating the sample to a constant mass. Dispose of solid as instructed by your teacher.

## Calculations

1. Calculate the percent by mass of magnesium in Epsom salt.
2. Calculate the percent by mass of sulfate in Epsom salt.
3. Calculate the percent by mass of water in Epsom salt.
4. Use these percentages to calculate the empirical formula of Epsom salt.

## Questions

1. Calculate the actual mass percentages from the reported empirical formula of Epsom salt.
2. Compare these values to the calculated from the lab. Explain in detail a possible cause for this variance.
3. Explain why were the solid crystals cooled in a desiccator before recording their mass?
4. What would happen to the percent of magnesium recovered if your Epsom salt solution became contaminated with barium ions while you were not looking?